SECTION 617
TRAFFIC SIGNALS AND LIGHTING

617.01 DESCRIPTION. This work is installing or modifying of traffic signal(s), lighting, and other electrical systems.

617.02 MATERIALS. Furnish materials meeting the following requirements:

Lighting and Signal Materials	Section 703
Paints	Section 710
Class "D" Portland Cement Concrete	Section 551

617.03 CONSTRUCTION REQUIREMENTS.

617.03.1 General. Obtain daily, safety circuit clearance from the servicing utility before starting work on existing series street lighting circuits. Pull cut-out plugs and place worker signs at cut-out boxes before work is started.

Pick up State-furnished material and equipment from the Department of Transportation, Traffic Engineering Section, 2701 Prospect Avenue, Helena, Montana, and transport to the project as part of the contract unit price. Provide the Traffic Engineering Section at least 48 hours advance notice before arriving to take delivery.

Repair or replace all existing improvements and equipment disturbed, damaged, or removed in performing the work at Contractor expense.

The locations in the Contract for signal and light standards, controller pedestals, conduit runs, pull boxes, illuminated signs, and appurtenances are approximate. The Project Manager will establish the exact field locations.

Furnish and install all incidental parts not specified but necessary to complete or modify the traffic signal, lighting, or other electrical systems at Contractor expense.

Make arrangements with the serving utility for providing service to the project.

Pay all fees and energy costs up to the time the project is accepted. The Department will pay for the energy costs to operate signals and lighting for public benefit, when ordered by the Project Manager.

All systems must be complete and operable when the work is completed.

See Section 703 for additional construction requirements.

617.03.2 Equipment Lists and Drawings. Submit within 60 calendar days of award, the following to the Project Manager for approval:

1. A complete list of the proposed equipment and material. Include the quantity, description, size, name of the manufacturer, and catalog number of each item.
2. Ten copies of the manufacturer's catalog sheets for each item of equipment and material listed. The catalog sheets must have the specific items to be used underlined in red include item specifications.
3. Ten copies of the shop drawings, design calculations, and welding procedures for all metal signal and luminaire standards. Check and approve the shop drawings and design calculations before submitting to the Project Manager. Show Contractor approval on the drawings.

The Department has 20 Working Days to approve the submittal's. Upon receipt of the approved list of equipment and material, immediately order the materials and

submit to the Project Manager copies of the dated purchase orders for major items. Re-submit any disapproved items for Department review within 20 working days of notification of disapproval.

Submit to the Project Manager copies of the invoices showing the shipping date(s) within 30 calendar days of the invoice dates.

The calendar date or the number of working days allowed for completion of the Contract will be adjusted by the number of days the Department's review of submittal's overrun the Department's review time.

Furnish for approval, 4 copies of the wiring diagrams for the controller cabinets and ten copies of the certified mill test reports for pole material. In lieu of certified mill test reports, provide the manufacturers certification that pole material and galvanizing meets specifications.

The Department is not liable for any material purchased, labor performed, or work delay (except as stated above) before approval of the required submittal's.

All material is subject to inspection after delivery to the project and during installation on the project. Failure by the Project Manager to note defective material or faulty workmanship during construction does not relieve the Contractor of responsibility for removing or replacing defective material or redoing work at its expense. Inspection or sampling of certain materials may be made at the factory or warehouse before delivery to the site at the Project Manager's discretion. No material rejected before delivery, is to be delivered to the project, and all material rejected on the project must be removed from the work.

Submit all equipment guaranties and warranties to the Project Manager.

617.03.3 Maintenance of Signals. Maintain existing traffic signals that are moved or modified once work begins.

The agency normally responsible for existing traffic signals will continue that responsibility until work begins.

Be responsible for new or modified traffic signals placed in service until the project is accepted. Provide in writing the names and phone numbers of the persons responsible for the operability and maintenance to the jurisdictional law enforcement agency and the Project Manager in case of signal malfunction.

617.03.4 Excavating and Backfilling. Excavate for conduit, foundations, other equipment and materials as specified. Excavate trenches to the width necessary to install electrical equipment, materials, and foundations. Saw cut all existing pavements before excavating.

Do not start excavation until the conduit, equipment, and materials are on site.

Place excavated material without obstructing vehicular or pedestrian traffic or surface drainage. Remove and dispose of surplus excavated material at the end of each workday.

Backfill excavations meeting Subsection 209.03.6 requirements. Bring excavations up level with the adjacent surface or grade to drain as required until permanent repairs are made.

When construction is suspended each day, clear all equipment and material from the roadway for public use as specified in Section 618.

Restore sidewalks, pavement, and landscaping at each intersection before starting work at other intersections. Restrict only one traffic lane for excavations in streets and highways at any time, following the approved traffic control plan.

617.03.5 Removing and Replacing Improvements. Replace or re-construct existing sidewalks, curbs, gutters, pavement, bituminous surfacing, base material, and other improvements removed, broken, or damaged by the Contractor with equal or better quality materials.

Cut concrete sidewalk and pavement borders to be removed without damaging the adjacent surface. Whenever a part of the existing concrete sidewalk, driveway or pavement is broken or damaged, remove the entire square or slab and replace the concrete as specified.

Repair or remove and replace all existing improvements damaged by the Contractor at its expense.

617.03.6 Foundations. Construct post, standard, controller cabinet, and pull box concrete encasing pad foundations using Class "D" portland cement concrete meeting the applicable requirements of Section 551.

Place the concrete foundation bottoms on undisturbed ground. Mono-lithically pour foundations where practical. Form the exposed faces. Assure forms are rigid and braced true to line and grade. Finish the footing tops for posts and standards, except special foundations, to the curb or sidewalk grade or as directed. Position and hold in place conduit ends and anchor bolts using a template until the concrete has set.

Apply an Ordinary Surface Finish to the exposed concrete surfaces meeting Subsection 552.03.12 (A).

Where obstructions prevent the construction of planned foundations, the Contractor may propose an alternate foundation construction method.

Posts, poles, standards, and pedestals may be erected, plumbed and raked after the foundation concrete has cured at least 72 hours.

617.03.7 Conductors and Wiring. Install wiring meeting the National Electric Code requirements.

Neatly arrange and lace wiring in cabinets, junction boxes, and the like.

Run conductors in conduit except inside poles. Remove all dirt and moisture from the conduit runs before pulling wiring. Use powdered soapstone, talc, or other approved lubricant when placing conductors in conduit.

Run signal light conductors without splices from a terminal block located in the cabinet, compartment, or signal head to a similarly located terminal block.

Splice conductors only where specified using approved watertight connectors.

Locate connectors in pole bases to be easily accessible through the handhole.

Leave at least 2 feet (610 mm) of slack for each conductor at each standard and pull box.

Use a conductor separate from the signal light circuit for all 24-volt circuits, such as pedestrian push-button circuits.

When conductors and cables are pulled through conduit, tape the conductor and cable ends to seal out moisture until the splices are made or terminal appliances attached. Tape the ends of spare conductors.

Tag cables at controller cabinets and poles to show routing. Provide color-coded wire diagrams for individual wire routing.

617.03.8 Span Wire-Mounted Signals. Install span wire suspended signals on overhead guys providing a sag of 5% of the total span distance.

Raise overhead guys with the signals attached, to the specified sag. Adjust the guy mounting height at either or both poles, or the sag, or the rake of steel poles so that the signals are at the specified height with the proper sag and the poles are plumb when completed. Do not pull guys beyond the specified sag.

617.03.9 Bonding and Grounding. Make metallic cable sheaths, conduit, and metal poles and pedestals mechanically and electrically secure to form a continuous grounded system. Use copper wire or strap of equal cross sectional area to a AWG No. 6 conductor for bonding and grounding jumpers. Use a No. 6 copper bonding strap, to bond standards and pedestals, attaching it to an anchor bolt and all conduit. Use a bare copper AWG No. 6 solid wire connected between the grounding lug on the standard or pedestal and the bonding strap. Ground one side of the secondary circuit of series-multiple transformers.

Ground conduit and neutrals at service points meeting the Electrical Code or this Section, except that AWG No. 6 conductor or equal shall be used for grounding.

Furnish and install nonferrous ground rods or approved equals of at least 5/8-inch x 8 feet (16 mm X 2.4 m) at each service point. Install ground rods meeting the Contract and Code requirements. Bond the service equipment to the ground rod using a ground clamp and a bare AWG metal No. 6 solid copper wire or equal enclosed in a 3/4-inch (21 mm) diameter schedule 80 plastic conduit.

617.03.10 Service Connections. Service pole locations shown in the Contract are approximate. The Contractor, Project Manager and serving utility will jointly determine the exact locations. The utility will specify the riser location when the Contractor is to install the lower section of a riser on a utility pole.

617.03.11 Conduit and Pull Boxes. Refer to Section 616.

617.03.12 Painting. Perform painting meeting Section 612 requirements.

Clean standards, frames, signal bridges, fittings, and other metal parts to be painted following the paint manufacturer's recommendations before applying paint.

Apply two coats of cold galvanizing compound to breaks, abrasions, and damaged galvanized surfaces. Undamaged, shop-coated metal parts do not require field priming.

Prepare galvanized surfaces to be painted following the paint manufacturer's recommendations or as follows if no recommendations are made:

Dissolve 2 ounces (59 mL) each of copper chloride, copper nitrate, and sal ammoniac in 1 gallon (3.8 L) of water in a glass container. Add 2 ounces (59 mL)

of commercial muriatic acid. Apply the solution to the galvanized surface with a wide, flat brush.

Apply one coat of primer after the surface develops a grey film.

Spot coat damaged surfaces with primer, once installed.

Apply two coats of enamel of the color specified below.

Factory-enamelled signal heads and fittings of black or dark olive-green in good condition will not require painting. Apply one coat of primer and two coats of enamel to signal heads that are un-painted or when directed.

Like components for the same intersection shall be the same color.

Apply one coat of primer to the backplates.

Apply two coats of flat black enamel to hood interiors and front faces of backplates.

Factory-enamelled controller cabinet exteriors in good condition do not require painting. Paint unpainted cabinet exteriors with one coat of primer and two coats of aluminum enamel.

Galvanized poles will not require painting except for repairing damaged surfaces.

Apply paint by hand brushing or spray equipment. The Project Manager will require brush painting if spraying produces unsatisfactory results.

617.03.13 Field Test. Conduct the following tests on traffic signal and lighting circuits with the Project Manager present before completing the work.

1. Test each circuit for continuity;
2. Test each circuit for grounds;
3. Perform a megger test on each vehicle detector loop between the loop and ground before and after sealing. The megger readings must exceed 10 megohms;
4. A functional test that demonstrates the system functions as specified.

617.03.14 Salvaging and Reinstalling Electrical Equipment.

A. **Salvaging Electrical Equipment.** Remove, clean, salvage, and stockpile or re-install existing electrical equipment as specified.

Underground conduit, conductors, and foundations not reused are the Contractor's property and must be removed. The materials may, with written approval, be abandoned in place.

Replace all electrical equipment damaged or destroyed during salvage operations at Contractor expense.

B. **Reinstalling Salvaged Electrical Equipment.** Furnish and install all necessary materials and equipment to complete the new installation.

617.04 METHOD OF MEASUREMENT.

617.04.1 Lump Sum. No measurement for payment is made.

617.04.2 Unit Basis. Measurement is as follows:

1. Conduit and pull boxes are measured under Subsection 616.04.2 (A) (B).
2. Concrete foundations are measured by the cubic yard (cubic meter) based on plan dimensions. Deductions are not made for the concrete displaced by

reinforcing steel, anchor bolts, and conduit. Foundation work includes backfill, furnishing reinforcing steel, electrical bonding, and restoring the surface around the foundation.

3. Cables, conductors, and treated timber poles are measured by the linear foot (meter) to the nearest foot (0.1 m), in place.
4. The following items are measured by the unit:
   - Standards
   - Controller Cabinet Pedestals
   - Controllers
   - Luminaire Assemblies
   - Service and Control Assemblies
   - Photoelectric Controls
   - Traffic Signals
   - Pedestrian Signals
   - Signal Standards
   - Detector Loops
   - Detector Loop Amplifiers
   - Pedestrian Push Buttons
   - Emergency Pre-emption Systems
   - Other component parts as specified in the Contract

617.05 BASIS OF PAYMENT. Payment for the completed and accepted quantities is made under the following:

617.05.1 Lump Sum. Payment is at the contract lump sum price.

617.05.2 Unit Basis. Payment is as follows:

Pay Item	Pay Unit
Conduit and Pull Boxes	See 616.05
Concrete	Cubic Yard (Cubic Meter)
Cables	Linear Foot (Linear Meter)
Conductors	Linear Foot (Linear Meter)
Treated Timber Poles	Linear Foot (Linear Meter)
Pull Boxes	Each
Standards	Each
Controller Cabinet Pedestals	Each
Controllers	Each
Luminaire Assemblies	Each
Service and Control Assemblies	Each
Photoelectric Controls	Each
Traffic Signals	Each
Pedestrian Signals	Each
Signal Standards	Each
Detector Loops	Each
Detector Loop Amplifiers	Each
Pedestrian Push Buttons	Each
Emergency Pre-emption Systems	Each
Other Components as specified in the Contract	Each

Payment at the contract unit price is full compensation for all resources necessary to complete the item of work under the Contract and to furnish and operational system.